

2011 Indiana Interstate Mobility Report

Summary Version



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INDOT

FOREWORD

Located at the crossroads of America, Indiana is a vital component of our national transportation network. The Indiana Interstate system includes more than 1,100 centerline miles. This mileage is roughly 10% of the Indiana Department of Transportation (INDOT) roadway system, but it carries over 35% of the vehicle miles traveled (approximately 16 billion vehicle-miles in 2011).

INDOT Is Committed to Delivering a First-Class Highway System

In 2006, INDOT launched Governor Mitch Daniels' 10-year transportation capital program known as Major Moves. Since 2006, the agency has invested more than \$7 billion in hundreds of roadway and bridge projects statewide. National studies indicate that congestion in Indiana has substantially decreased during this period, but there is evidence that there are still opportunities to improve our interstate system. It is essential to prioritize those investments.

Performance Measures Are a Tool for Objectively Prioritizing Investments

In collaboration with our partners at Purdue University, we have defined a series of performance measures that leverage emerging probe vehicle data to shape our infrastructure investment priorities, as well as assess their effectiveness once a capital project has been completed or a roadway operations strategy implemented.

We believe the probe vehicle performance measures and innovative presentation formats described in this report open a new frontier in best practices for transportation planning, and provide an unprecedented opportunity to greatly improve how we prioritize competing capital project and roadway operation investment decisions.



Ryan Gallagher
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INTRODUCTION

Since pioneer days, Indiana has been at the intersection of several north-south and east-west transportation corridors. As Figure 1 shows, even after the completion of the interstate construction program in the 1970s, Indiana remains at the crossroads of America. In fact, approximately 82 million people live within 500 miles of Indianapolis, and 65% of the U.S. population is within a day's drive. Consequently, the Indiana Department of Transportation's stewardship of the Indiana interstate system is important not only to the residents of and businesses located within Indiana, but also to our nation, because this system provides a vital link in the U.S. interstate highway network.

To assist in managing this asset, it is important to develop performance measures that characterize gross trends and also identify emerging operational challenges as the Indiana economy and traffic grow. This report quantitatively and qualitatively characterizes the 2011 congestion of 943 centerline miles of Indiana Interstates 64, 65, 69, 70, 74, 94, and 465 (Figure 2) to assess statewide mobility. The Indiana toll road (I-90) and some short sections such as I-469 are not included in this year's analysis.



Figure 1. United States Interstate Highway Network.

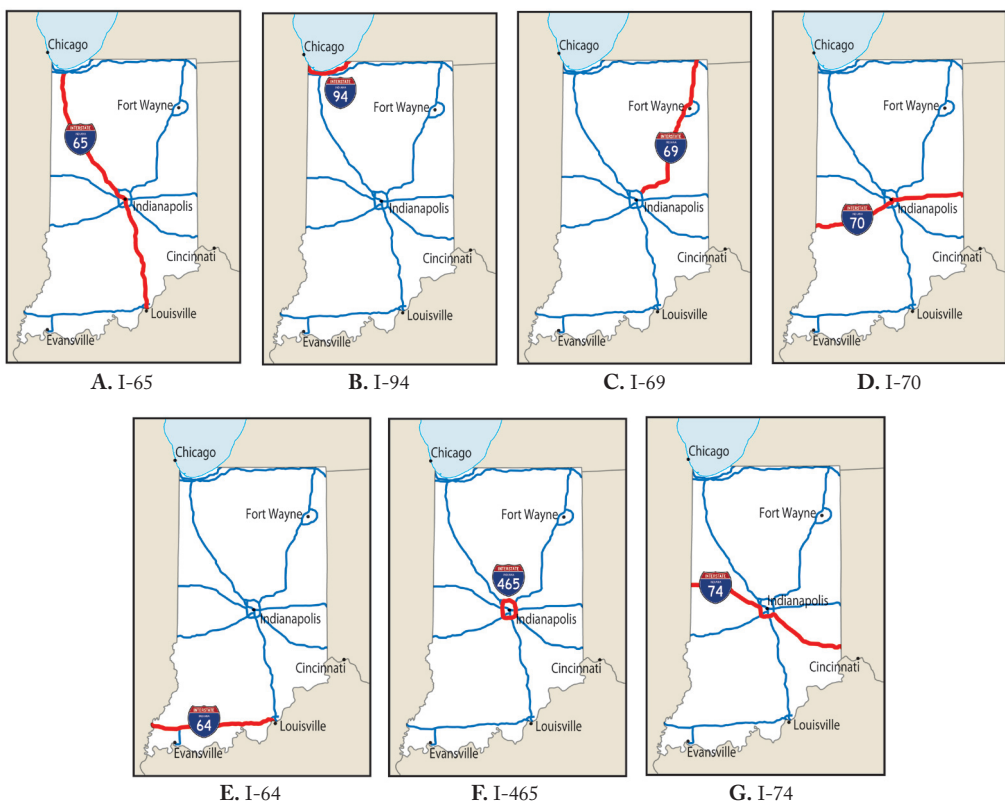


Figure 2.
Indiana interstates.

HIGHWAY PERFORMANCE MEASURES

Developing rational and transparent performance measures is essential to guide infrastructure investment decisions and assess outcomes. For highway systems, a diverse portfolio of potential performance measures can be identified for consideration. Traditionally, performance measures have been oriented toward asset conditions such as pavement smoothness, visibility of pavement markings, age of signs, and condition of bridges. Congestion and motorist delay performance measures are often used to make investment decisions on isolated projects such as signalized intersection improvements. However, states have historically had insufficient data to develop statewide performance measures to characterize the amount of congestion at a regional or statewide level. This report provides a qualitative and quantitative characterization of congestion to assess statewide mobility. It includes performance measures to assist in the prioritization of potential infrastructure investments and assess the impact of capital construction projects. This is the first edition of what is expected to be an annual report for Indiana on statewide mobility.

NATIONWIDE MOBILITY ASSESSMENTS

Mobility is a general term that refers to the movement of people or goods. The Texas Transportation Institute (TTI) for many years has conducted a Mobility Assessment on a national scale. TTI's September 2011 press release for its calendar year 2010 assessment reported the following national mobility facts (<http://mobility.tamu.edu/ums/media-information/press-release/>):

- The amount of delay endured by the average commuter was 34 hours, up from 14 hours in 1982.
- The cost of congestion is more than \$100 billion, nearly \$750 for every commuter in the United States.
- “Rush hour” is 6 hours of not rushing anywhere.
- Congestion is becoming a bigger problem outside of rush hour, with about 40% of the delay occurring in the midday and overnight hours, creating an increasingly serious problem for businesses that rely on efficient production and deliveries.

The 2010 TTI Report evaluated congestion data for 101 metropolitan areas throughout the country, Indianapolis being the only city in Indiana analyzed. The report indicated that in 2010 the Indianapolis metropolitan region incurred approximately \$443 million in congestion costs composed of:

- \$119 million in truck congestion (approximately \$84 billion transported commodities)
- \$324 million in vehicle congestion (approximately \$506 per commuter)

The report rankings compared the largest metropolitan areas using a variety of indexes, with the first ranking being the worst for each category. The Indianapolis area ranked as follows:

- 37th in total congestion costs
- 32nd in truck congestion costs
- 47th in congestion cost per commuter (improved 9 ranking positions from 2005)

The national report does not provide detailed commuter route assessments identifying where improvements were made, or where further effort to reduce congestion might be needed.

DEFINING INDIANA MOBILITY PERFORMANCE MEASURES

To effectively prioritize investments in Indiana infrastructure that will have the biggest rate of return, there is a need to systematically assess select commuter and freight routes. These data then can be used to identify potential infrastructure investments, and ultimately to assess the impact of capital construction projects after completion.

For the purposes of quantifying interstate congestion using a simple to understand metric, an Indiana interstate route is considered congested when the average speed falls below 45 mph.

Highway Speed Data Source

There are a number of commercial data sources available that provide real-time, color-coded maps routinely used by motorists to provide traffic condition information such as that shown in Figure 3. In exchange for allowing users to view real-time maps on their mobile devices, the provider's mobile application sends speed and location information to a private sector centralized server. This crowd-sourced, real-time data can be used by motorists to plan alternate

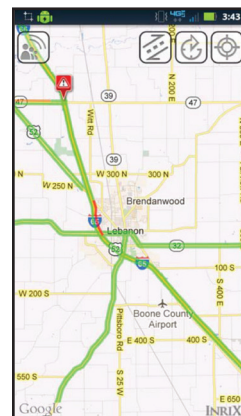


Figure 3. Private sector mobile application to crowd source travel data in return for live travel conditions.

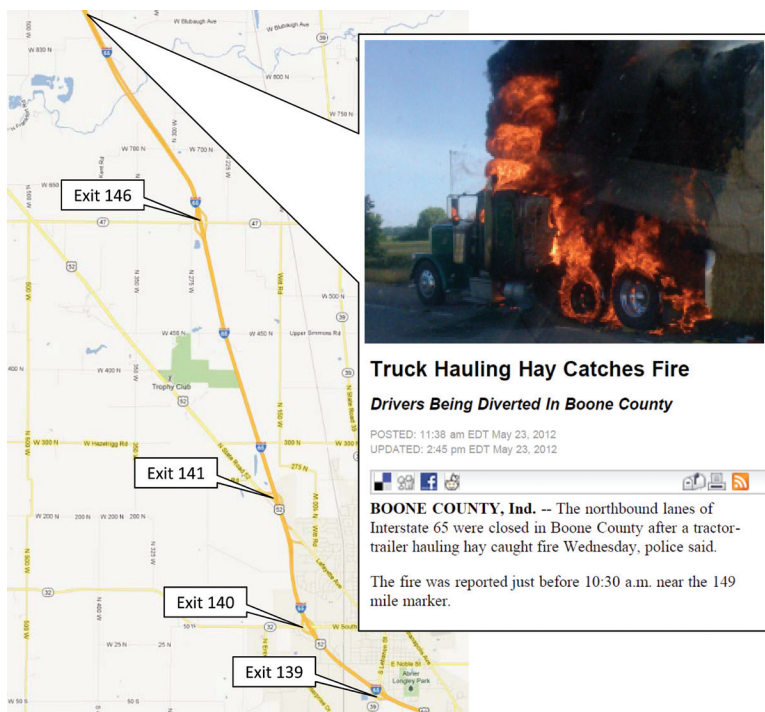


Figure 4. Location of truck fire on I-65 that resulted in diversion at Exit 141.

and 5) are useful for travelers to select the best routing in near real time, these graphics targeted at motorists are not scalable for an agency to assess how over 943 centerline miles of interstate are performing on a month-to-month basis. However, the private sector also archives the speed data characterizing the minute-by-minute and day-by-day variation in travel speeds along sections of the highway. This archived data is a powerful tool for agencies to assess the performance of the interstate highway network. This is a data source unavailable before mobile phones became prevalent.

Indiana Interstate Coverage and Example Highway Segments

This report covers approximately 943 centerline (1,886 directional) miles of Indiana Interstates 64, 65, 69, 70, 74, 94, and 465 (see Figure 2). Approximately 300 million one-minute average segment speed records were obtained from a commercial data provider, Inrix (<http://www.inrix.com/>). Those speed records correspond to directional road segments, each with a unique segment ID, length, and location. The road segments on interstates are separated at exit and entrance ramps.

To illustrate the granularity and fidelity of the data, Figure 6 shows a small section of I-65 near Lebanon, Indiana, with three segments in the southbound direction and three segments in the northbound direction. Segments A, C, D, and F are examples of shorter segments between interchange exit and entrance ramps. Segments B and E are substantially longer segments between interchanges. Figure 6B shows how different segments of this section of I-65 have different average speeds for the period shown.

routes during congested conditions. A recent example took place on May 23, 2012, when a truck caught fire resulting in the closure of a section of northbound I-65 (see Figure 4). Figure 5 shows the impact of this truck fire on Interstate 65, where traffic is being diverted at Exit 141. In fact, when we look at the segment shown in red (Figure 5 at i) and the corresponding legend (Figure 5 at ii), we can see that the segment speed is between 11 and 20 mph.

Although these real-time maps (Figures 3

Throughout the entire Indiana interstate highway network, identified segments range in length from 0.003 miles to 14 miles. Each segment can be linked to a subset of the 300 million speed records provided by Inrix. This link between a known segment location and variable speeds provides the basis for creating performance measures over a defined period of time and/or a particular highway.

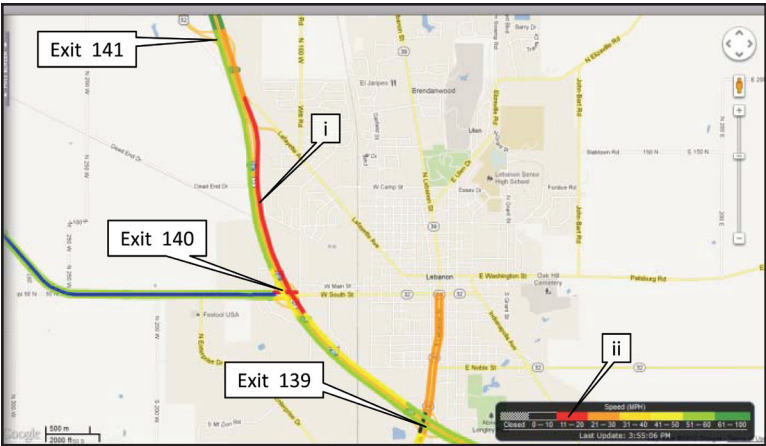


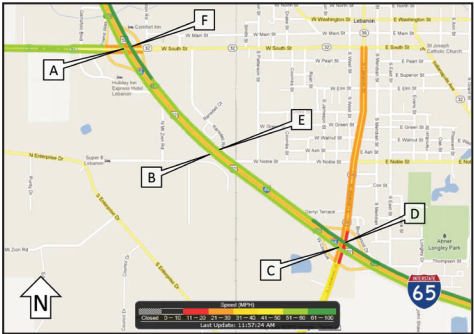
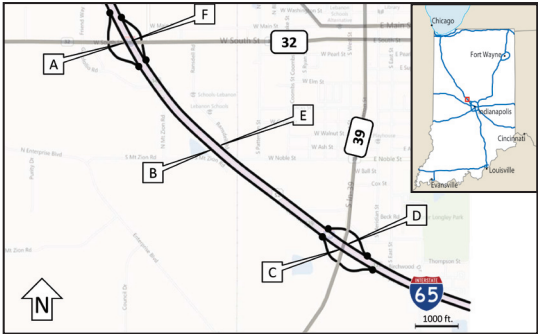
Figure 5. Real-time traffic conditions on I-65 south of Exit 141 diversion.

Performance Measures for Characterizing Interstate Congestion

Using the speed and segment information provided by Inrix, the following performance measures were developed to analyze local and regional congestion on Indiana interstates.

- **Congestion hours:** Number of hours an interstate segment or series of segments has an average speed of less than 45 mph. This number is useful for plotting on a map to show congestion “hot spots” or characterizing the performance of short segments.
- **Weighted congestion hours:** Number of congestion hours multiplied by the segment length in miles. This is used to provide weighting of segments so that congestion along longer segments gets more consideration than congestion along shorter segments.
- **Congestion index:** Number of weighted congestion hours divided by the aggregated total lane mileage of analyzed segments. This measure is useful for comparing congestion levels between interstates that vary in length, for example I-65 versus I-70.

Figure 6. Interstate segments on I-65 near Lebanon, Indiana.
A (Left). Segments identified
B (Right). Real-time data



CONGESTION PERFORMANCE MEASURE GRAPHICS

The raw data provided by commercial data providers is best characterized as data rich, information poor (DRIP). Data visualization tools were used to reduce the 300 million records from 692 segments into this report. Several approaches were used to visualize mobility in Indiana. A detailed explanation of each approach follows, and summary graphs for the entire state are provided in Appendices A and B of the full version of this report. Details for obtaining the full version are on page 25.

2011 Interstate Congestion Hours

By tabulating by interstate segment the accumulated hours of speeds below 45 mph (congestion hours), a table or graphic can be constructed that characterizes the location and magnitude of congestion along an interstate route. An annotated case study from I-65 follows.

Figure 7 (Top).

Northbound I-65 at mile marker 140 (SR 32) near Lebanon, Indiana.

Figure 8 (Bottom).

Increased congestion on I-65 southbound to Louisville, Kentucky, due to I-64 closure.

Figures 7 through 9 are photographs of congestion along I-65. Figure 10 (southbound) and Figure 11 (northbound) show a graphical representation of where, when, and how much congestion occurs along the 262 miles of I-65. Horizontal dotted lines depict exit numbers and approximate locations where I-65 intersects state routes and U.S. routes. The left axis along each graph corresponds to the distance from the Indiana/Kentucky border along I-65, terminating at I-94. As illustrated in Figures 10 and 11, construction congestion occurs around Exit 140 adjacent to SR 32 near Lebanon. For

context, Figure 7 shows a highway sign that corresponds to the construction shown in Figure 11 (at h) around SR 32; note the construction activities near this area. Furthermore, the slowdown upon entering and exiting the toll road can be observed north of I-94. Callouts (a-j) identifying sections along I-65 with congestion are shown in Figures 10 and 11. Although there was already considerable morning congestion on the section of I-65 near Louisville (marked “Louisville Metro Area”), the monthly hours of congestion increased substantially during the period September to



December of 2011 due to the increased number of vehicles using this section of I-65 when the I-64 bridge to Louisville was closed for maintenance. A photograph of this section of I-65 southbound is shown in Figure 8. In the northbound direction of I-65 near Louisville, a new pocket of congestion developed just south of I-265 (see Figure 11, callout j) as evening commuter traffic queued on I-65 to enter the I-265 ramp (see Figure 9).

Appendix A of the full version of this report contains a complete set of figures for all interstate routes in Indiana.

2011 Weighted Interstate Congestion Hours

Weighted congestion hours are computed by multiplying the segment length in miles by the hours of congestion in that segment. This measure provides a weighting proportional to the segment length, which allows comparison of congestion levels between multiple interstate segments of varying length. These corridor segments can define an entire interstate, region, metropolitan area, rural area, or travel direction. An example of weighted interstate congestion hours is Figure 12, which illustrates the total number of weighted congestion hours for I-65 by direction.

As shown in Figure 12, southbound congestion on I-65 is typically greater than northbound congestion. Of particular note is that January and February show substantial impact associated with winter weather conditions. This is not necessarily surprising, but it provides a good quantitative and qualitative assessment of the magnitude of winter weather when January and February are compared with March and April. To provide some context for how much the congestion on I-65 between I-265 and Louisville contributes to the total congestion on I-65, Figure 13 shows just the southbound I-65 congestion and highlights what portion of the delay is in the Louisville area. In March and April, the 7 miles of I-65 in the Louisville region accounted for just under half of all southbound congestion along the 262 miles of I-65. In September, this 7-mile section accounted for approximately 70% of all I-65 southbound congestion.



Figure 9. Evening commuter congestion on I-65 at I-265.

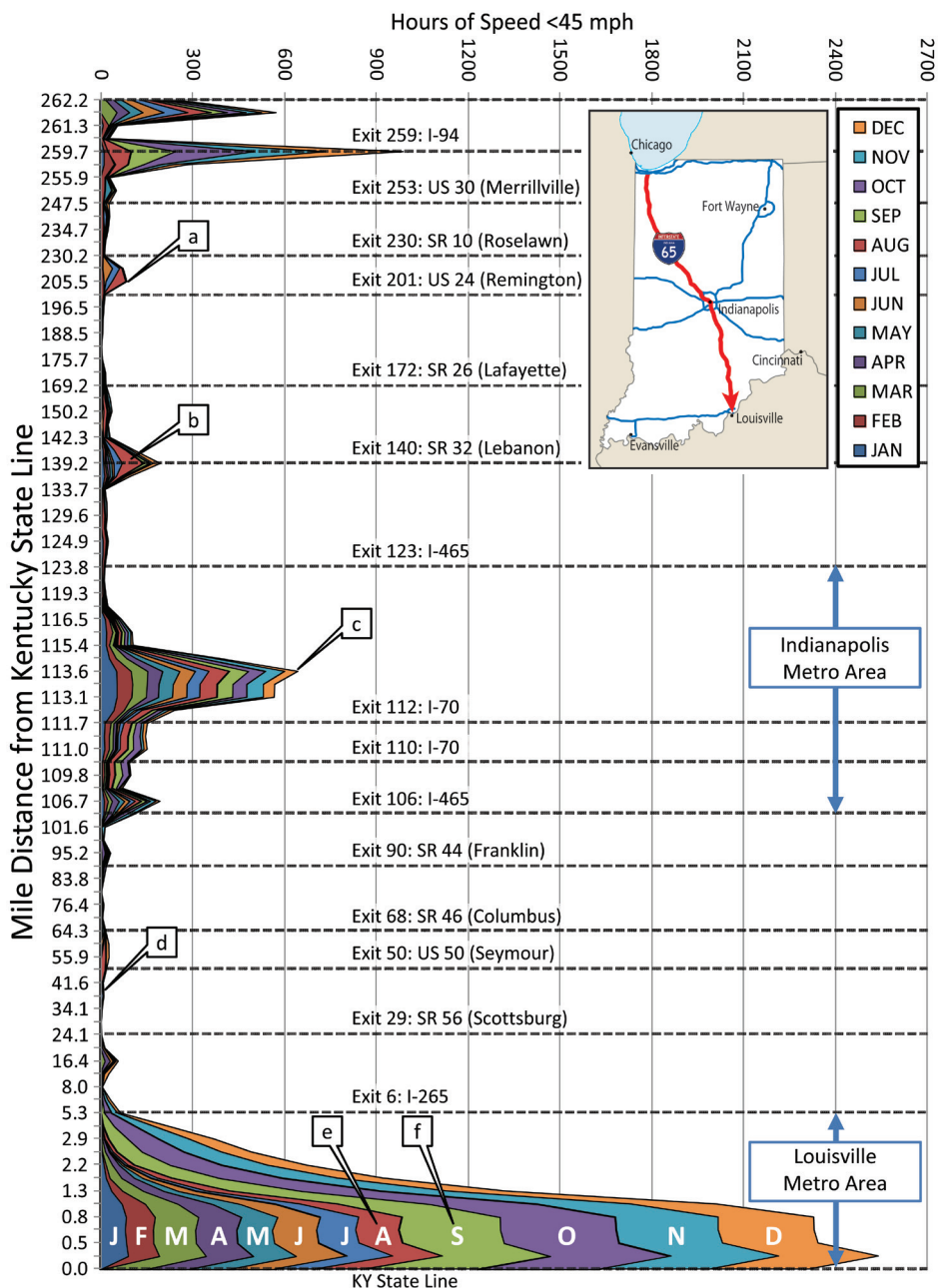


Figure 10. Location of I-65 southbound congestion hours color coded by month.

- Construction work zone associated with guardrail and under drain maintenance.
- Construction work zone associated with reconstruction near Lebanon.
- Congestion in downtown area of Indianapolis. Notice the relatively uniform magnitude of delay for each month. This is an example of recurring congestion on I-65 inside the I-465 loop.
- Rural segment with minimal congestion.
- Congestion associated with travel to Louisville during the months of June, July, and August was relatively uniform.
- On September 9, a section of I-64 was closed resulting in significant diversion of traffic from I-64 to I-65.

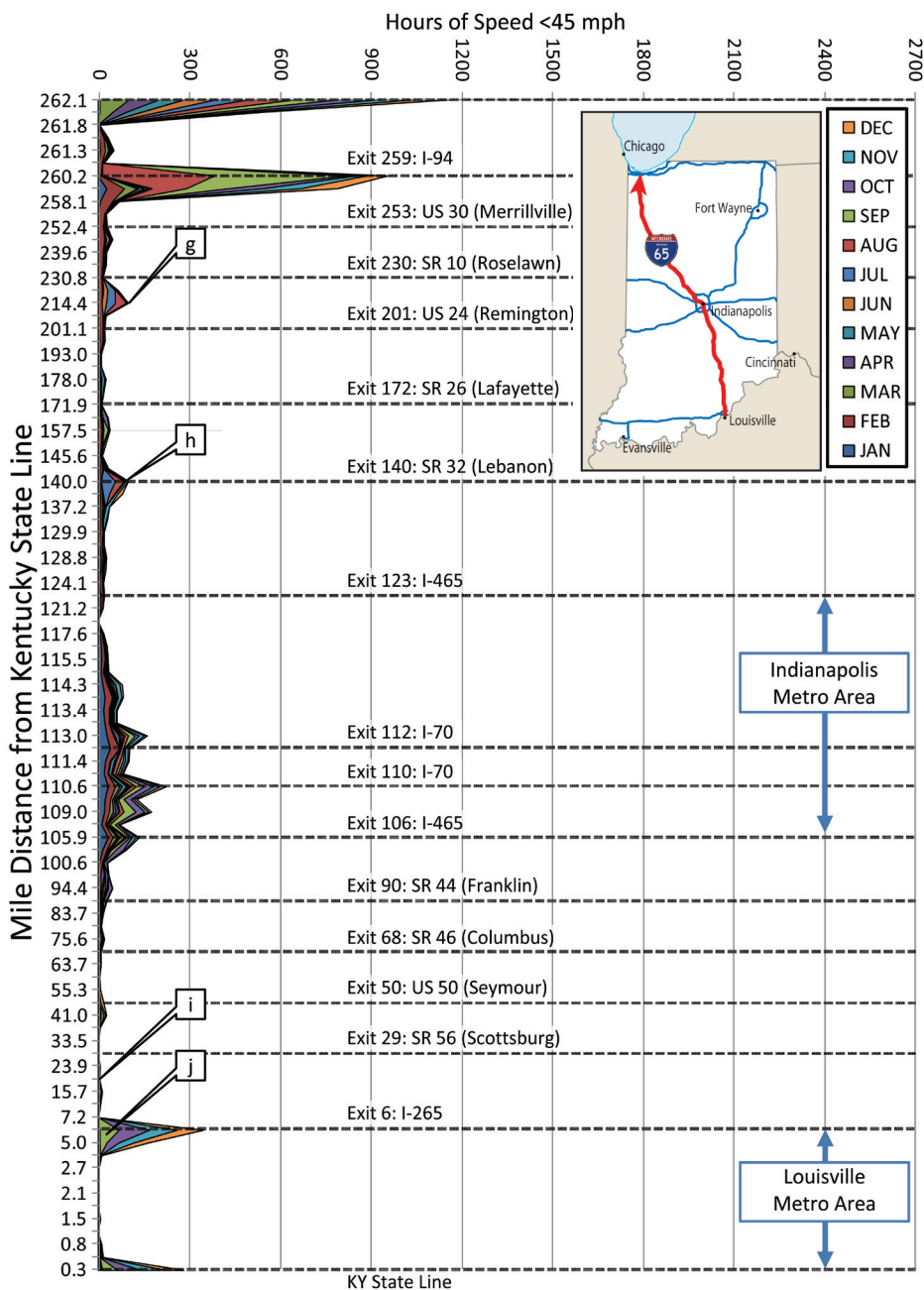


Figure 11. Location of I-65 northbound congestion hours color coded by month.

- g. Construction work zone associated with guardrail and under drain maintenance.
- h. Construction work zone associated with reconstruction near Lebanon.
- i. Rural segment with minimal congestion.
- j. On September 9, a section of I-64 was closed resulting in significant diversion of traffic from I-64 to I-65.

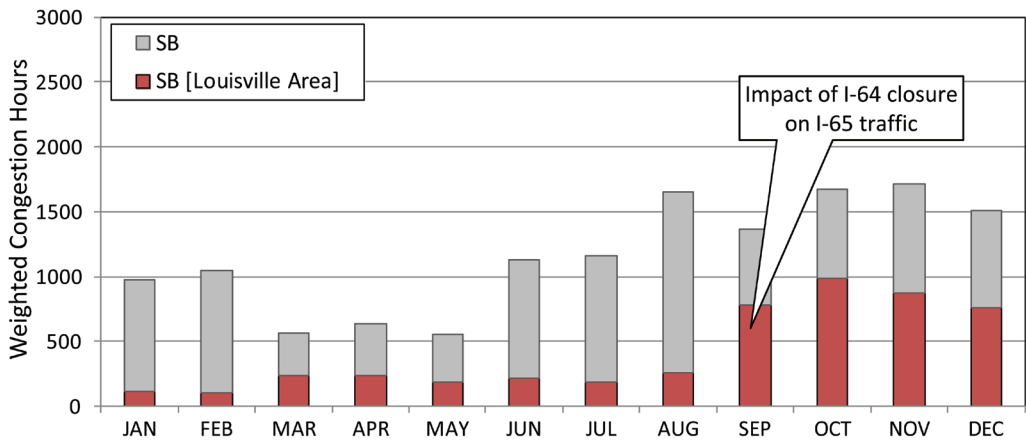
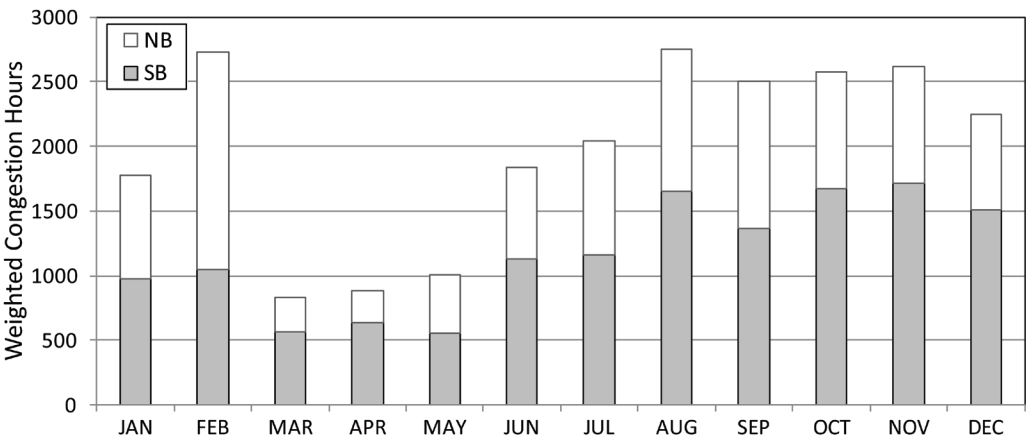
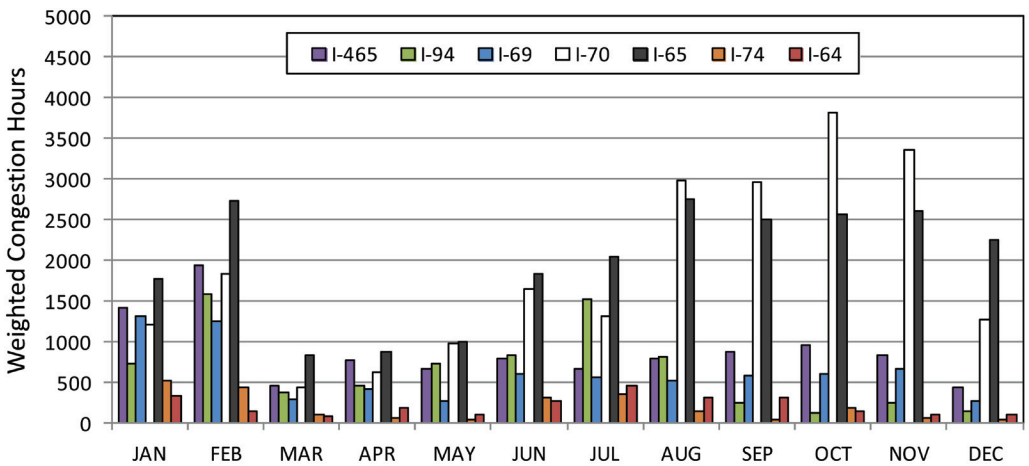
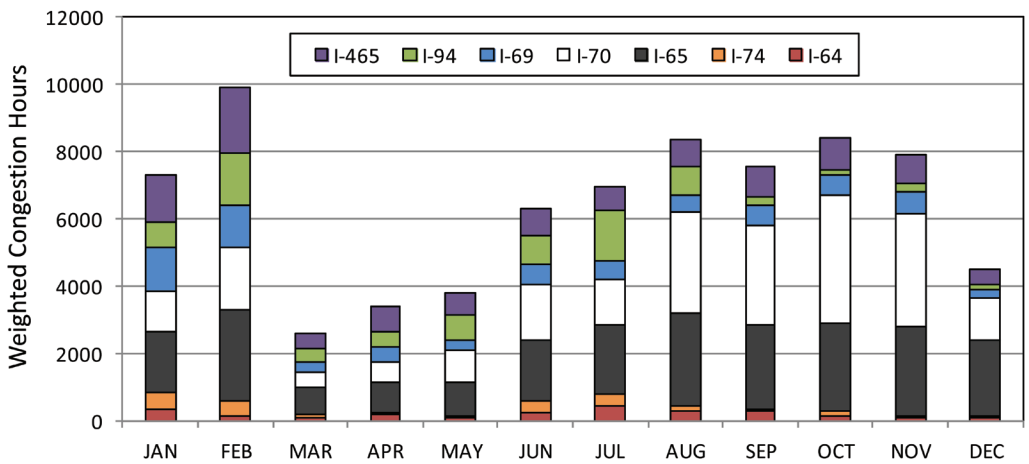


Figure 12 (Top). I-65 weighted congestion hours by direction.

Figure 13 (Bottom). Southbound I-65 weighted congestion hours by direction, with congestion between I-265 and Louisville, Kentucky, shown as a different color.

To provide an overall comparison of the magnitude of congestion on all Indiana interstates, Figure 14A shows the combined delay for both directions of travel on all interstate routes. Not surprisingly, Figure 14A shows the impact of winter weather in January and February similar to that shown in Figure 12. Figure 14B shows exactly the same data as Figure 14A, but the bars are shown side by side instead of stacked to allow comparison of the magnitude of congestion between corridors. Often short corridors such as I-64 have fewer weighted hours of congestion. One exception is a segment of I-70 that had significant construction west of Indianapolis from August through November.



A photograph of this nonrecurring congestion on I-70 adjacent to Indianapolis International Airport is shown in Figure 15. In contrast, Figure 16 shows what is commonly referred to as recurring congestion on a section of I-70 that is associated with the morning commute into Indianapolis. Appendix B of the full version of this report contains more details with a complete set of graphs for all interstate routes similar to Figure 12 with congestion hours shown by month, by direction.

Figure 14. Weighted congestion hours summary for Indiana interstates.
 A (Top). Data shown stacked
 B (Bottom). Data shown side by side



Figure 15 (Top).
Nonrecurring congestion on westbound I-70 adjacent to Indianapolis International Airport.

Figure 16 (Bottom).
Recurring congestion on westbound I-70 adjacent to Emerson Avenue, Indianapolis.

2011 Interstate Congestion Index

To provide a performance metric that is not biased by the length of the route, a congestion index is calculated by dividing the weighted congestion hours by the total lane mileage of an interstate. This normalized index is useful for comparing congestion on interstates with different lengths, for example I-65 versus I-70. A comparison among all major Indiana interstates is shown in Figure 17, where taller bars indicate more congestion.

- Figure 17 shows the same general impact of winter weather as Figures 12 and 14. However, Figure 17B suggests that I-465 was the most impacted by winter weather, perhaps due to the ice storm that passed through central Indiana at the end of January and first days of February.
- In general, I-465 has the highest congestion index, perhaps due to its location in an urban area and a number of work zones.
- Once the construction activity ended on I-94 in August, there was a substantial reduction in congestion.

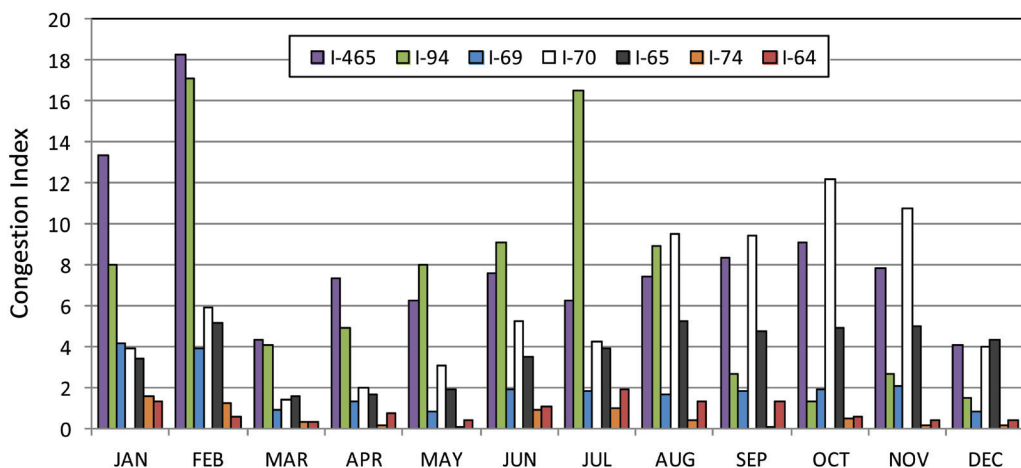
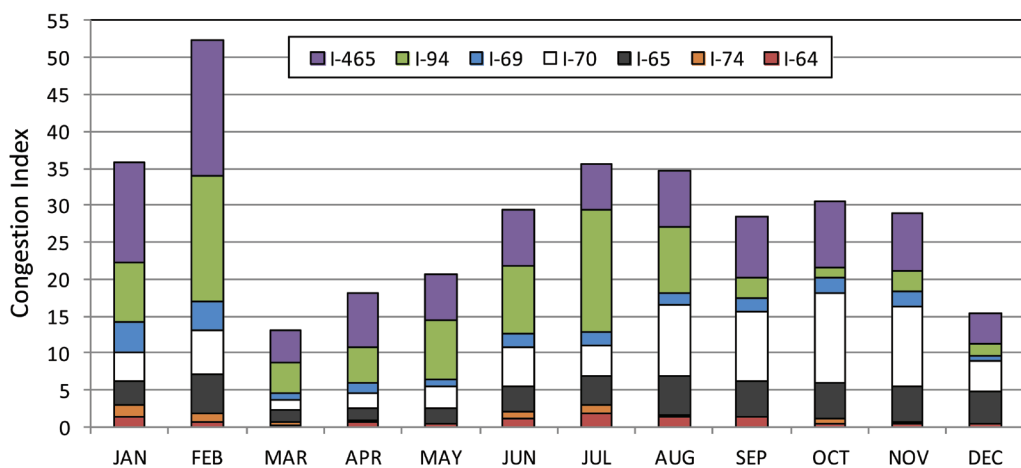


Figure 17. Normalized congestion hours index for Indiana interstates.

A (Top). Data shown stacked
B (Bottom). Data shown side by side

System-Wide Congestion Summary and Location Ranking

In summary, three congestion performance measures were developed to analyze local and regional congestion on Indiana interstates. The applications of each are as follows:

Performance Measure	Application
Congestion hours	<ul style="list-style-type: none">• Simple, absolute measurement of delay useful for analyzing short segments in an easy to understand format• Analyzing entire interstate when used in a graphical format showing location of delay, as shown in Figures 10 and 11
Weighted congestion hours	<ul style="list-style-type: none">• Calculating the magnitude of congestion with road segments of varying lengths• Comparing how corridor congestion varies over time, as shown in Figure 14
Congestion index	<ul style="list-style-type: none">• Determining average congestion per mile of an interstate route• Directly comparing interstate routes with variable lengths, as shown in Figure 17

Figures 10, 11, 14, and 17 show the differences and applications of the three performance measures. These metrics, in addition to being used to assess and compare highways (as a long system), can be used to develop ranked lists that allow identification of the location of congestion at a relatively detailed level. For example:

- Table 1 lists the segments on the interstate that experience the most hours of congestion. The first seven of these segments listed in Table 1 are located just north of Louisville and correspond to the area labeled as the Louisville Metro Area in Figure 10. The segment with the eighth largest number of congested hours is a 0.7-mile section of eastbound I-94 between the Illinois border and I-65. With I-94 construction now approaching completion, we expect this segment to show substantial improvement in 2012.
- Table 2 list the segments on the interstate that experience the most hours of congestion, weighted by segment length. In this case, segments associated with 2011 work zones generally appear at the top of the list.

Both the weighted congestion hours and the congestion index are appropriate for comparing entire interstate routes. Techniques for using Figures 14 and 17 were described earlier in the 2011 Weighted Interstate Congestion Hours section of this report. Tables 3 and 4 provide the numerical data corresponding to these figures that can be used for ranking congestion at an interstate route level.

Rank	Commuter Corridor Code	Interstate and Direction	Starting Mile Marker	Ending Mile Marker	Congestion Hours	Length in Miles
1	L-4	I-65 SB	0.5	0.4	2,541	0.12
2	L-4	I-65 SB	0.7	0.5	2,344	0.15
3	L-4	I-65 SB	0.8	0.7	2,331	0.07
4	L-4	I-65 SB	0.9	0.8	2,330	0.15
5	L-4	I-65 SB	0.4	0	2,315	0.42
6	L-4	I-65 SB	1.3	0.9	2,014	0.37
7	L-4	I-65 SB	1.7	1.3	1,323	0.44
8	G-3	I-94 EB	9.8	10.5	1,244	0.73
9	G-3	I-94 EB	9.5	9.8	1,190	0.28
10	G-1	I-65 NB	262	262.1	1,171	0.05
11	G-3	I-94 EB	8.7	9.5	1,091	0.74
12	G-1	I-65 SB	260.4	259.7	989	0.77
13	G-1	I-65 NB	259.4	260.2	956	0.81
14	L-4	I-65 SB	2.2	1.7	923	0.42
15	G-1	I-65 NB	258.4	259.4	790	1.07
16	G-3	I-94 EB	6.9	8.7	755	1.8
17	—	I-465 IL	34.1	34.9	678	0.84
18	L-4	I-65 SB	2.5	2.2	672	0.3
19	I-1	I-65 SB	113.8	113.6	645	0.22
20	G-1	I-65 SB	262.2	262.1	574	0.04
21	I-1	I-65 SB	113.6	113.4	570	0.11
22	I-1	I-65 SB	113.4	113.1	568	0.35
23	—	I-465 IL	13.9	15.2	547	1.3
24	I-6	I-70 WB	83.1	82.1	538	1
25	G-1	I-65 NB	261.8	262	537	0.22
26	—	I-465 OL	16.6	15.9	522	0.67
27	L-4	I-65 SB	2.9	2.5	494	0.44
28	—	I-465 IL	15.2	15.7	489	0.45
29	G-3	I-94 EB	6.3	6.9	473	0.66
30	—	I-465 OL	15.9	15.3	462	0.59
31	I-10	I-69 SB	2.9	2.3	448	0.6
32	—	I-465 IL	33	34.1	435	1.03
33	I-11	I-465 IL	51.1	52.2	420	1.17
34	—	I-465 OL	17.2	16.6	391	0.62
35	I-1	I-65 SB	114.8	113.8	388	0.99
36	G-3	I-94 EB	5.9	6.3	381	0.36
37	I-10	I-69 SB	5.4	4.4	375	0.99
38	L-4	I-65 SB	3.6	2.9	372	0.63
39	L-4	I-65 NB	5	5.4	347	0.46
40	I-5	I-70 EB	79.9	80.6	329	0.63

Table 1. Congestion hours rankings of Indiana interstate segments. *EB*, eastbound; *WB*, westbound; *NB*, northbound; *SB*, southbound; *IL*, inner loop (clockwise direction); *OL*, outer loop (counterclockwise direction).

Rank	Commuter Corridor Code	Interstate and Direction	Starting Mile Marker	Ending Mile Marker	Weighted Congestion Hours	Length in Miles
1	—	I-70 EB	22.5	36.5	1,839	13.93
2	—	I-70 WB	65.5	60.5	1,402	4.55
3	G-3	I-94 EB	6.9	8.7	1,358	1.80
4	—	I-65 SB	229.6	215.3	1,071	14.28
5	I-10	I-69 SB	10.4	5.4	1,040	5.02
6	—	I-70 EB	40.5	49.5	976	8.96
7	L-4	I-65 SB	0.4	0	963	0.42
8	—	I-65 NB	215.1	229.3	941	14.25
9	—	I-70 EB	49.5	56	919	6.29
10	—	I-65 NB	205.3	214.4	914	9.14
11	G-3	I-94 EB	9.8	10.5	902	0.73
12	I-5	I-70 WB	72.4	68.4	880	4.04
13	—	I-70 WB	103	95.5	868	7.11
14	G-1	I-65 NB	258.4	259.4	845	1.07
15	—	I-70 EB	95	102.5	836	7.09
16	—	I-70 EB	60.5	65.5	831	4.45
17	G-3	I-94 EB	8.7	9.5	808	0.74
18	—	I-65 SB	214.7	205.5	800	9.20
19	I-7	I-70 WB	95.5	91	783	4.60
20	G-1	I-65 NB	259.4	260.2	778	0.81
21	G-1	I-65 SB	260.4	259.7	761	0.77
22	L-4	I-65 SB	1.3	0.9	749	0.37
23	—	I-70 EB	4	7	729	2.93
24	—	I-465 IL	13.9	15.2	709	1.30
25	I-10	I-69 NB	5.4	10	701	4.58
26	I-7	I-70 EB	90.5	95	698	4.62
27	—	I-70 WB	49.5	40.5	694	9.01
28	—	I-69 NB	116	126	618	9.96
29	—	I-70 EB	11.5	22.5	588	10.70
30	L-4	I-65 SB	1.7	1.3	584	0.44
31	—	I-465 IL	34.1	34.9	572	0.84
32	—	I-70 WB	37	22.5	571	13.93
33	I-6	I-70 WB	83.1	82.1	536	1.00
34	—	I-70 EB	114.5	122.5	525	7.09
35	—	I-70 EB	36.5	40.5	498	3.46
36	I-11	I-465 IL	51.1	52.2	490	1.17
37	—	I-70 WB	56	49.5	486	6.15
38	I-10	I-69 SB	4.4	2.9	477	1.49
39	—	I-465 IL	33	34.1	449	1.03
40	—	I-70 WB	11.5	7	447	4.22

Table 2. Weighted congestion hours rankings of Indiana interstate segments. *EB*, eastbound; *WB*, westbound; *NB*, northbound; *SB*, southbound; *IL*, inner loop (clockwise direction); *OL*, outer loop (counterclockwise direction).

Rank	Road	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	I-65	1,772	2,727	828	881	1,006	1,838	2,041	2,753	2,503	2,576	2,616	2,253	23,794
2	I-70	1,219	1,843	438	623	977	1,639	1,322	2,986	2,960	3,821	3,368	1,265	22,461
3	I-465	1,416	1,938	458	775	667	803	664	791	883	961	832	438	10,626
4	I-94	737	1,576	376	455	738	837	1,522	823	246	122	247	140	7,819
5	I-69	1,315	1,246	302	421	274	602	572	526	580	605	661	264	7,368
6	I-64	331	152	80	185	101	273	468	323	323	143	103	97	2,579
7	I-74	534	438	109	73	45	310	354	140	42	180	72	49	2,346
Total	All	7,324	9,920	2,591	3,413	3,808	6,302	6,943	8,342	7,537	8,408	7,899	4,506	76,993

	Road	Length (mi)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
1	I-465	106	13.4	18.3	4.3	7.3	6.3	7.6	6.3	7.5	8.3	9.1	7.9	4.1	8.4
2	I-94	92	8.0	17.1	4.1	4.9	8.0	9.1	16.5	8.9	2.7	1.3	2.7	1.5	7.1
3	I-70 ¹	311	3.9	5.9	1.4	2.0	3.1	5.2	4.2	9.5	9.5	12.2	10.8	4.0	6.0
4	I-65	524	3.4	5.2	1.6	1.7	1.9	3.5	3.9	5.3	4.8	4.9	5.0	4.3	3.8
5	I-69	316	4.2	3.9	1.0	1.3	0.9	1.9	1.8	1.7	1.8	1.9	2.1	0.8	1.9
6	I-64	247	1.3	0.6	0.3	0.8	0.4	1.1	1.9	1.3	1.3	0.6	0.4	0.4	0.9
7	I-74 ²	290	1.8	1.5	0.4	0.3	0.2	1.1	1.2	0.5	0.1	0.6	0.2	0.2	0.7
Totals		1,886	36.0	52.5	13.1	18.3	20.8	29.5	35.8	34.7	28.5	30.6	29.1	15.3	

¹Excludes lane miles that run concurrent with I-65.

²Excludes lane miles that run concurrent with I-465.

CHARACTERIZING TRAVEL TIME FOR LOCAL INTERSTATE ROUTES

The time it takes to travel along a particular route varies based on a number of factors, including but not limited to traffic volume and number of lanes. This variability of travel time is typically of interest to commuters. In general, plotting how travel time varies along an entire stretch of interstate is not very useful. For example, plotting the travel time from I-94 to Kentucky (262 miles) is probably much less useful than plotting how the travel time varies from I-265 to the Kentucky state line (7.1 miles). Since there are vast sections of I-65 that experience very little congestion, only selected commuter routes (e.g., from I-265 to the Kentucky state line) are presented in this report. For the purposes of characterizing this commuter travel time, free flow is defined as the expected travel time during ideal conditions. Delay is defined as the time exceeding these free flow conditions. The AM peak delay reported is the largest delay between the hours of 6:00 AM and 10:00 AM. The PM peak delay reported is defined as the largest delay between the hours of 3:00 PM and 7:00 PM.

2011 Interstate Commuter Corridor Travel Times

Travel times were calculated for 20 interstate commuter routes with variable distances, dispersed throughout Indiana. Figure 18 shows the locations of these corridors, and Table 5 identifies corridors for which travel time summaries were prepared. To characterize the weekday traffic conditions and travel time reliability that can be expected for someone traveling along one of these routes, the following were created for each corridor:

- Location and volume data (Figure 19A)
- Summary travel time graphs (Figure 19B)

Table 3 (Top).

2011 Weighted congestion hours.

Table 4 (Bottom).

2011 Normalized congestion hours index.

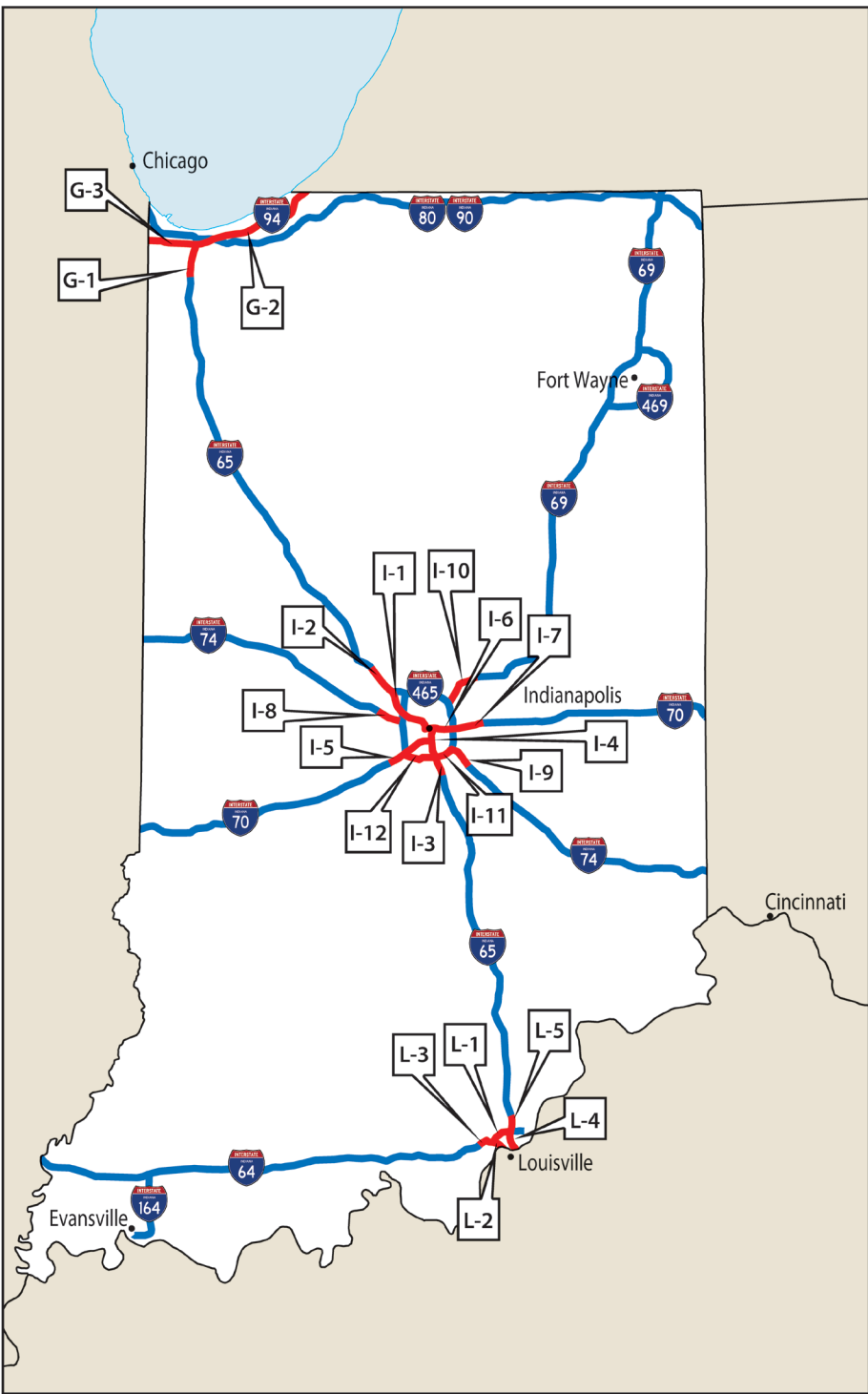


Figure 18. Interstate commuter corridors evaluated in this report.

Interstate	Common Name	Commuter Corridor Code	Direction	Closest Starting Mile Marker	Closest Ending Mile Marker	Appendix C Page No.
Northern Region						
I-65	US-30 to I-94	G-1	NB	253	259	C2
			SB	259	253	C4
I-94	I-65 to Michigan state line	G-2	EB	12	45	C6
			WB	45	12	C8
I-94	I-65 to Illinois state line	G-3	EB	00	11.5	C10
			WB	11.5	00	C12
Central Region						
I-65	I-465 to downtown split (northern Indianapolis)	I-1	NB	112	123	C14
			SB	123	112	C16
I-65	I-865 to I-465 (northern Indianapolis)	I-2	NB	123	129	C18
			SB	129	123	C20
I-65	Greenwood to I-465 (southern Indianapolis)	I-3	NB	99	106	C22
			SB	106	99	C24
I-65	I-465 to downtown split (southern Indianapolis)	I-4	NB	106	110	C26
			SB	110	106	C28
I-70	Indianapolis International Airport to downtown split	I-5	EB	68.5	80.5	C30
			WB	80.5	68.5	C32
I-70	I-465 to downtown split (eastern Indianapolis)	I-6	EB	83	89	C34
			WB	89	83	C36
I-70	Mt. Comfort to I-465 (eastern Indianapolis)	I-7	EB	90	96	C38
			WB	96	90	C40
I-74	Brownsburg to I-465 (northwest Indianapolis)	I-8	EB	66	73	C42
			WB	73	66	C44
I-74	Fairland to I-465 (southeast Indianapolis)	I-9	EB	94	99	C46
			WB	99	94	C48
I-69	Fishers to I-465	I-10	NB	00	10	C50
			SB	10	00	C52
I-465	I-70 to I-65 (eastern Indianapolis)	I-11	EB	53	44	C54
			WB	44	53	C56
I-465	I-70 to I-65 (western Indianapolis)	I-12	EB	09	00	C58
			WB	00	09	C60
Southern Region						
I-265	I-64 to I-65	L-1	EB	00	06	C62
			WB	06	00	C64
I-64	I-265 to Kentucky state line	L-2	EB	122	123.5	C66
			WB	123.5	122	C68
I-64	Duncan to I-265	L-3	EB	118	121	C70
			WB	121	118	C72
I-65	I-265 to Kentucky state line	L-4	NB	00	06	C74
			SB	06	00	C76
I-65	Sellersburg to I-265	L-5	NB	06	09	C78
			SB	09	06	C80

Table 5. Commuter corridors with travel time summaries.

Figure 19. 2011 Weighted congestion hours.

A (Top). Detailed corridor map outlining measured travel time values
 B (Bottom). Quarter 4 (Oct.–Dec. 2011) travel times (50th and 85th percentiles)

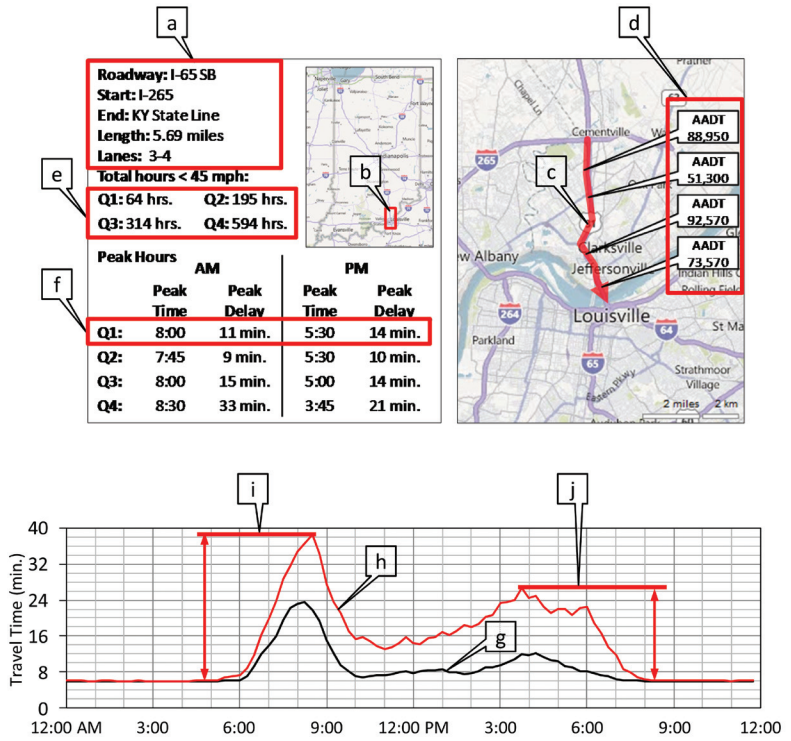


Figure 19 callouts (a–j) identify the following elements:

- General corridor information
- Location within Indiana
- Path and direction of the corridor being analyzed
- Average annual daily traffic (AADT) at selected locations; AADT is defined as the number of vehicles that pass a location on an average day
- Total weekday hours per quarter where speed is below 45 mph for that corridor
- Expected delay at the AM and PM rush hours
- Median (50th percentile) travel time by hour; half of the weekday travel times can be expected to be longer and half can be expected to be shorter
- 85th percentile travel time by hour; 15% of the weekday travel times can be expected to be longer, and 85% can be expected to be shorter
- AM peak delay is estimated by taking the difference between the 85th percentile travel time (39 minutes) and the free flow travel time (6 minutes); it occurs at approximately 8:30 AM
- PM peak delay is estimated by taking the difference between the 85th percentile travel time (27 minutes) and the free flow travel time (6 minutes); it occurs at approximately 3:45 PM

Appendix C of the full version of this report contains commuter travel time summary statistics for the interstate corridors listed in Table 5. These summaries are partitioned into four 3-month periods (quarters 1 through 4). Notes pertaining to recurring congestion and delays are included.

Travel Time Examples

This report references the impact that construction projects on I-94, I-70, and I-65 have had on overall congestion hours. To provide some context with regard to what a typical motorist might experience with each of the construction activities, Figures 20, 21, and 22 provide quarterly travel time plots for selected directions.

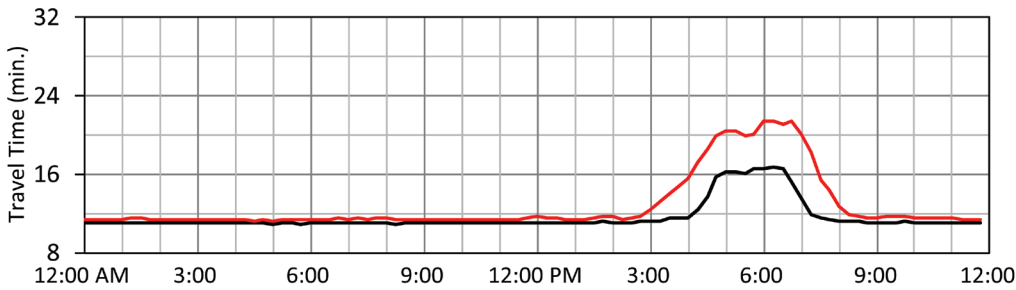
- Figure 20 shows the eastbound travel time for an 11-mile section of I-94 between the Illinois border and I-65 for four quarters. Lane restrictions associated with construction activities in the first two quarters resulted in peak travel times of about 22 minutes in the first quarter (Figure 20A) and almost 28 minutes in the second quarter (Figure 20B). The third quarter, when construction is ending, has similar peak travel times, but the median PM peak travel time reduced to about 12 minutes (Figure 20C). In the fourth quarter, when construction finished, typical travel times were on the order of 11 minutes (Figure 20D).
- Figure 21 shows the westbound travel times on I-70 from downtown to Indianapolis International Airport. In general, this 14-mile corridor could be traversed in about 14 minutes in the first two quarters, when there was not queuing associated with construction (Figure 21A, B). During the third quarter, it was not uncommon for this trip to take 40 minutes in the afternoon (Figure 21C). By the fourth quarter, when construction had been completed, the typical travel time returned to 14 minutes (Figure 21D).
- Figure 22 shows the southbound travel times on I-65 from I-265 to the Kentucky state line. The typical morning travel times in the first two quarters peaked at about 16 minutes for this 7-mile section (Figure 22A, B). Late in the third quarter the I-64 Sherman-Minton Bridge was closed for maintenance, which resulted in substantial additional traffic on I-65. During the fourth quarter, it was not uncommon to see the morning peak travel times around 40 minutes, with substantial delay throughout a good portion of the day due to the increase in I-65 traffic (Figure 22D).

SUMMARY OF INDIANA'S MOBILITY AND APPLICATION

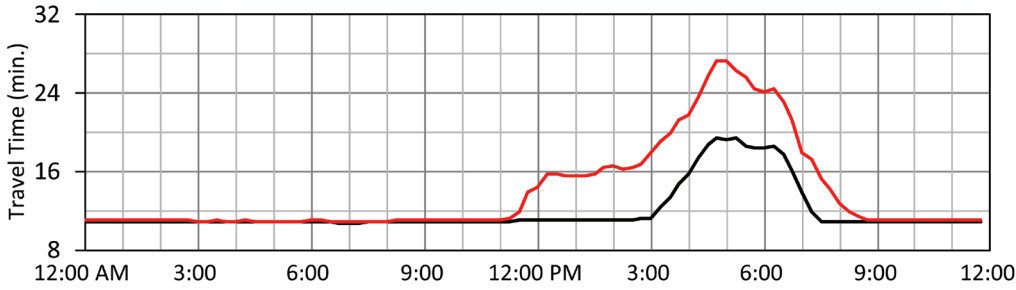
Management and infrastructure investment decisions made by the INDOT executive staff have a significant impact on the mobility of both Indiana residents and the entire country. This report provides a qualitative and quantitative characterization of how 1,886 directional miles of Indiana interstates are performing. Tools described in this report for identifying pockets of congestion will serve the state well for prioritizing future infrastructure investments, as well as evaluating the impact those projects have once they are completed.

In calendar year 2011, there was a total of 76,993 weighted congestion hours on Indiana interstates. Although this is a relatively large number, a substantial amount of the congestion on I-465, I-70, and, I-94 was associated with transient events, such as a severe winter ice storm and construction projects. On a macroscopic basis, performance measures such as those shown in Figures 14 and 17 (and corresponding Tables 3 and 4) are important tools used to quantify trends, determine where we are improving, and identify where we may need to invest additional resources to preserve the current level of mobility.

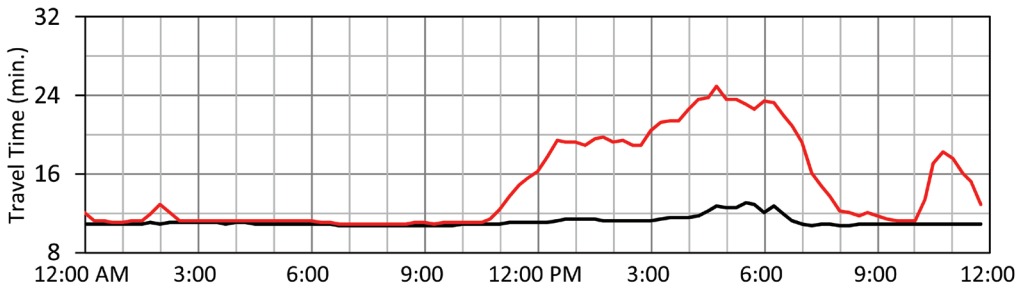
Figure 20. Eastbound I-94 (Illinois state line to I-65) quarterly travel times.



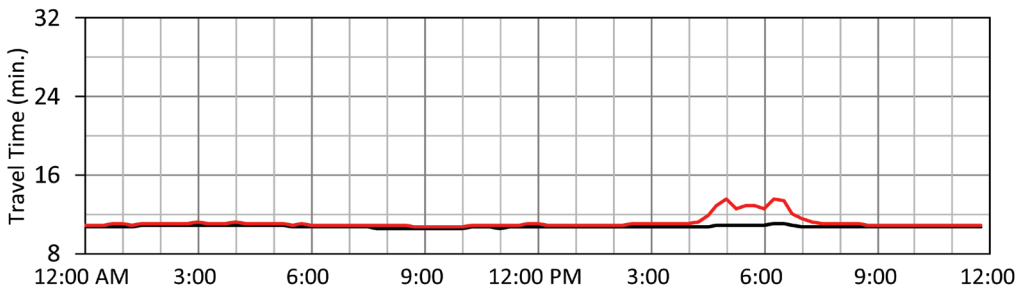
A. Quarter 1 (Jan.-Mar. 2011) travel times (50th and 85th percentiles)



B. Quarter 2 (Apr.-Jun. 2011) travel times (50th and 85th percentiles)

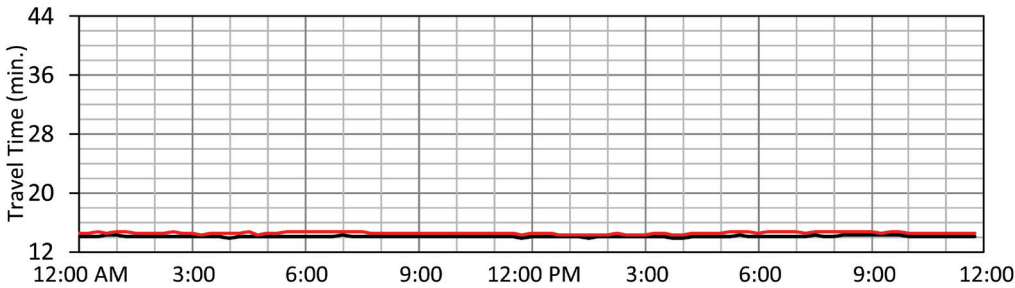


C. Quarter 3 (Jul.-Sep. 2011) travel times (50th and 85th percentiles)

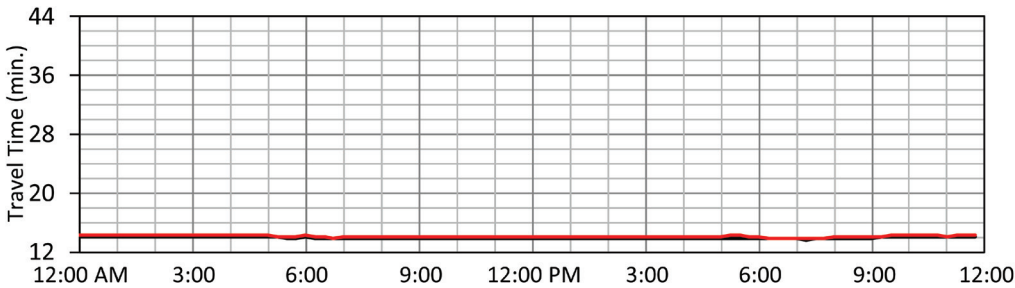


D. Quarter 4 (Oct.-Dec. 2011) travel times (50th and 85th percentiles)

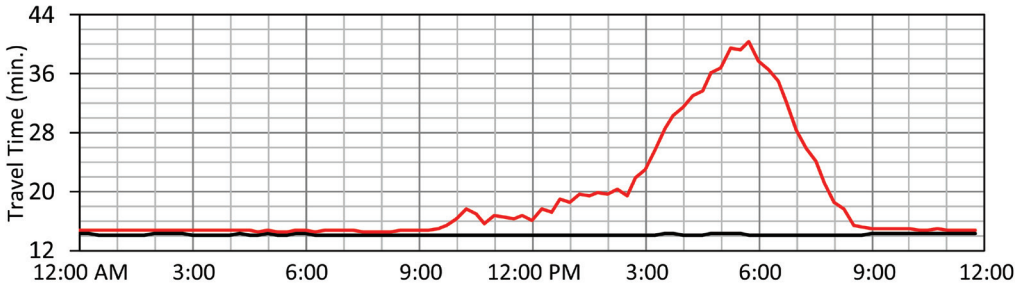
Figure 21. Westbound I-70 (downtown to Indianapolis International Airport) quarterly travel times.



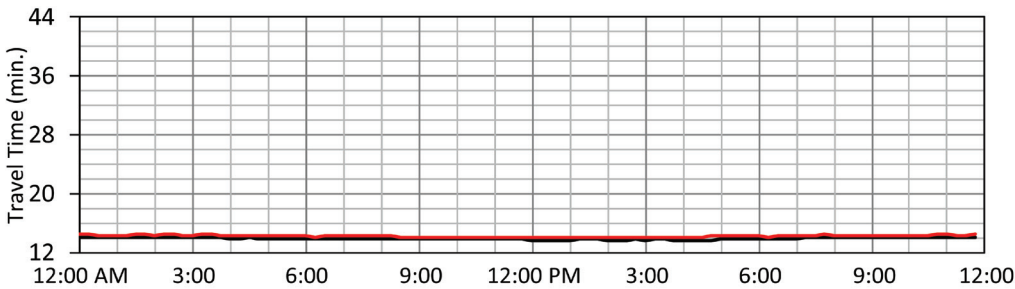
A. Quarter 1 (Jan.-Mar. 2011) travel times (50th and 85th percentiles)



B. Quarter 2 (Apr.-Jun. 2011) travel times (50th and 85th percentiles)

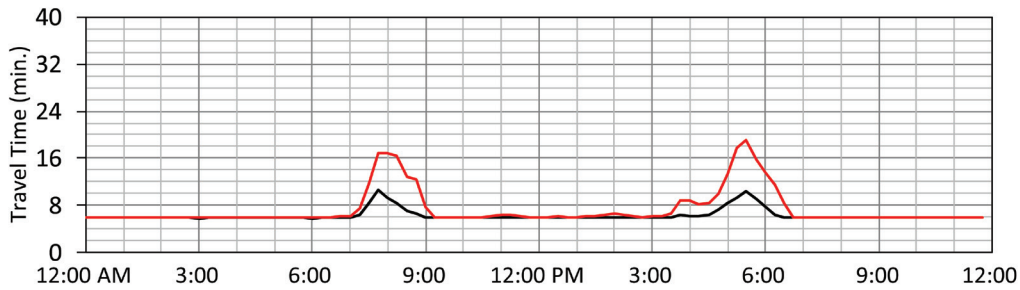


C. Quarter 3 (Jul.-Sep. 2011) travel times (50th and 85th percentiles)

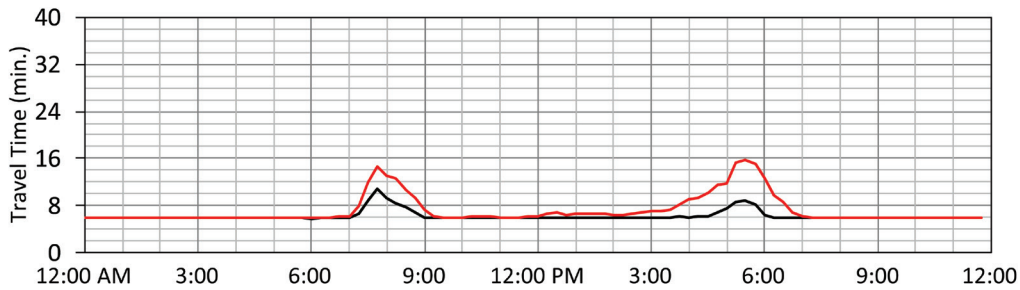


D. Quarter 4 (Oct.-Dec. 2011) travel times (50th and 85th percentiles)

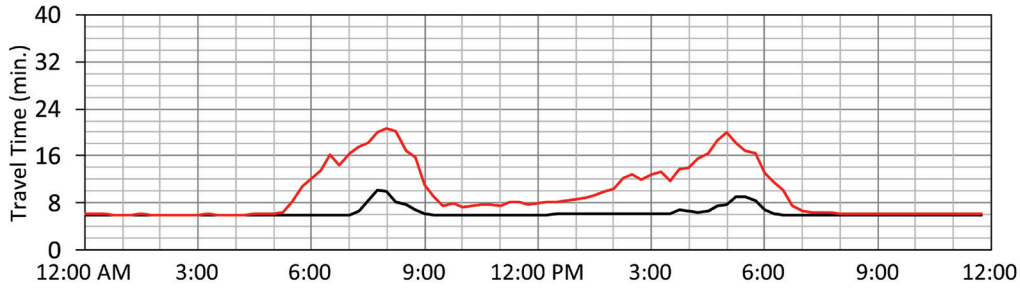
Figure 22. Southbound I-65 (I-265 to Kentucky state line) quarterly travel times.



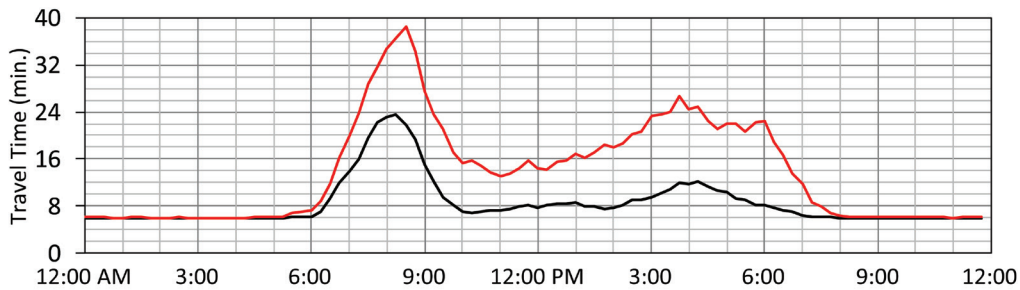
A. Quarter 1 (Jan.-Mar. 2011) travel times (50th and 85th percentiles)



B. Quarter 2 (Apr.-Jun. 2011) travel times (50th and 85th percentiles)



C. Quarter 3 (Jul.-Sep. 2011) travel times (50th and 85th percentiles)



D. Quarter 4 (Oct.-Dec. 2011) travel times (50th and 85th percentiles)

FUTURE MOBILITY REPORTS

This document represents the Indiana Department of Transportation's inaugural statewide mobility report. Additional corridors and performance measures will be incorporated in subsequent reports, including the logical extension of weighting of these mobility measures by vehicular volume and commercial freight. The following e-mail address has been established to provide a structured mechanism for submitting improvement suggestions: mobilityreport@purdue.edu.

Report Location

Both the 2011 Indiana Interstate Mobility Report—Summary Version and the 2011 Indiana Interstate Mobility Report—Full Version (which includes appendices) are archived on Purdue e-Pubs (<http://docs.lib.purdue.edu/imr/>) and are available free of charge to online users. Future reports will be archived here as well. Print versions of these reports are also available to purchase from the Purdue e-Pubs pages or through major booksellers.

Remias, S., T. Brennan, G. Grimmer, E. Cox, D. Horton, and D. Bullock. 2011. Indiana Interstate Mobility Report—Summary Version. *Indiana Mobility Reports*. 2012. doi: 10.5703/1288284314679, ISBN 978-1-62260-208-7.

Remias, S., T. Brennan, G. Grimmer, E. Cox, D. Horton, and D. Bullock. 2011. Indiana Interstate Mobility Report—Full Version. *Indiana Mobility Reports*. 2012. doi: 10.5703/1288284314680, ISBN 978-1-62260-209-4.

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About the Joint Transportation Research Program (JTRP)

Just over 75 years ago, on March 2, 1937, the Indiana General Assembly passed a resolution that the motto for Indiana would be “The Crossroads of America.” Nine days later, on March 11, 1937, the Indiana General Assembly passed enabling legislation that led to the formation of the Joint Highway Research Project (JHRP) to facilitate collaboration between Purdue University and what was then known as the Indiana State Highway Commission. The Joint Highway Research Program was renamed the Joint Transportation Research Program (JTRP) in 1997 to reflect the state and national efforts to integrate

the management and operation of various transportation modes.

The first studies of JHRP were concerned with Test Road No. 1—evaluation of the weathering characteristics of stabilized materials. After World War II, the JHRP program grew substantially and was regularly producing technical reports on a diverse portfolio of transportation-related research projects.

Over 1,500 technical reports are currently available, published as part of the JHRP and subsequently JTRP collaborative venture between Purdue University and what is now the Indiana Department of Transportation. Free online access to all reports is provided through a unique collaboration between JTRP and Purdue Libraries. These are available at <http://docs.lib.purdue.edu/jtrp>. Since 2006, there have been over 333,000 downloads of these reports worldwide.

Further information about JTRP and its current research program is available at <http://www.purdue.edu/jtrp>.



Top. Construction of new I-65 Ohio River Crossing (1962).

Bottom. Completed I-65 Ohio River Crossing (2012).

ISBN 978-1-62260-208-7

